* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] In case this invention connects a semiconductor device to a wiring substrate by face down, it relates to the mounting method of the semiconductor device performed by making resin material intervene among both.
[0002]
[Description of the Prior Art] In recent years, the semiconductor device to which the number of electrode terminals exceeds 1000 is being produced commercially by progress of semiconductor integrated circuit technology. Technology which carries out bonding of the semiconductor device to the wiring substrate which comes to form a predetermined circuit pattern on an insulating substrate efficiently with high density is desired with the formation of a many-items child of this semiconductor device.
[0003] As the conventional mounting method which carries out bonding of many electrode terminals of a semiconductor device in package on the predetermined circuit pattern of a wiring substrate side, there are technique shown, for example in JP,62-132331,A or JP,62-169433,A and technique shown in JP,4-352439,A. Drawing 4 and drawing 5 explain the conventional mounting method indicated by these official reports.
[0004] Drawing 4 is a cross section for explaining the conventional mounting method mounted using the resin by which potting was carried out on a wiring substrate, this drawing (a) shows the state before mounting, and this drawing (b) shows the state after mounting. In addition, drawing 4 shows the mounting method shown in JP,62-132331,A or JP,62-169433,A.
[0005] the connection by which 1 was formed in the semiconductor device and 2 was formed in the electrode terminal which is not illustrated [of the aforementioned semiconductor device 1] in drawing 4 -- public funds -- it is a group salient 3 is a wiring substrate and the circuit pattern 4 of a predetermined configuration is formed in the upper surface (principal plane). 5 is the hardenability contraction resin by which potting was carried out to the upper surface of the aforementioned wiring substrate 3.
[0006] In order to mount a semiconductor device 1 in the wiring substrate 3, first, as shown in this drawing (a), potting of the hardenability contraction resin 5 is carried out to the predetermined position of the wiring substrate 3, and a semiconductor device 1 is positioned above the wiring substrate 3 after that. At this time, alignment of the metal salient 2 for connection is carried out to this and the corresponding circuit pattern 4.
[0007] Next, the aforementioned hardenability contraction resin 5 is hardened and shrunk, carrying out the pressure welding of the semiconductor device 1 to the wiring substrate 3, as shown in this drawing (b). if a semiconductor device 1 is made to approach the wiring substrate 3 at this time, the hardenability contraction resin 5 will press by the semiconductor device 1 first -- having -- the wiring substrate 3 top -- spreading -- after that and connection -- public funds -- the group salient 2 comes to be opposite-**(ed) by the circuit pattern 4
[0008] the hardenability contraction resin 5 hardens and contracts -- connection -- public funds -- where

the group salient 2 is connected to the circuit pattern 4 on the principal plane of the wiring substrate 3, a semiconductor device 1 will be fixed to the wiring substrate 3
[0009] Drawing 5 is a cross section for explaining the conventional mounting method of pouring in and mounting a resin between a semiconductor device and a wiring substrate, this drawing (a) shows the state where the semiconductor device was put on the wiring substrate, this drawing (b) shows the state where the resin is poured in, and this drawing (c) shows the state after mounting. Drawing 5 shows the conventional mounting method shown in JP,4-352439,A. About the same as that of what was explained by aforementioned drawing 4 in drawing 5 , or an equivalent member, the same sign is attached and detailed explanation is omitted.
[0010] In drawing 5 , while 6 heats a semiconductor device 1, the heating pressure-welding head for carrying out a pressure welding to the wiring substrate 3 and 7 are the nozzles for sinking in for pouring in the hardenability contraction resin 5.
[0011] In order to mount a semiconductor device 1 in the wiring substrate 3, as shown in drawing 5 (a), a semiconductor device 1 is first positioned on the wiring substrate 3. Occasionally, alignment of the metal salient 2 for connection is carried out, and it is made to opposite-** to this this and corresponding circuit pattern 4. And these both are heated while carrying out the pressure welding of the semiconductor device 1 to the wiring substrate 3 by the heating pressure-welding head 6.
[0012] Subsequently, as shown in drawing 5 (b), the nozzle 7 for sinking in is arranged to the side of a semiconductor device 1, and the hardenability contraction resin 5 is poured in and infiltrated into the crevice between a semiconductor device 1 and the wiring substrate 3 from this nozzle 7 for sinking in. by stiffening the hardenability contraction resin 5 after an appropriate time shows to drawing 5 (c) -- as -- connection -- public funds -- where the group salient 2 is connected to the circuit pattern 4 on the principal plane of the wiring substrate 3, a semiconductor device 1 will be fixed to the wiring substrate 3

[0013] thus -- the conventional mounting method -- a semiconductor device 1 -- connection -- public funds -- the technique of protruding the group salient 2 and connecting this to the circuit pattern 4 of the wiring substrate 3 was taken
[0014]
[Problem(s) to be Solved by the Invention] however, it mentioned above -- as -- a semiconductor device 1 -- connection -- public funds -- protruding the group salient 2 -- if -- it will have to pass through a salient formation process in mounting, the number of connection processes will increase, and the lead time of a connection process will become long And it also needs to be furnished for forming the metal salient 2 for connection.
[0015] moreover, connection -- public funds -- in order to affect greatly the reliability of the electrical installation after dispersion in the height of the group salient 2 connecting -- connection -- public funds -- the manufacture deflection of the height of the group salient 2 needed to be controlled according to the flatness of the wiring substrate 3 which connects
[0016] Since the reliability of a semiconductor device 1 will fall from a damp-proof viewpoint if the hardenability contraction resin 5 infixed between a semiconductor device 1 and the wiring substrate 3 has little the amount of supply, it is required to carry out to potting **** disagreeable sink in with sufficient amount which flows out of a semiconductor device 1 into the circumference to some extent. For this reason, the space which had the margin into which the hardenability contraction resin 5 may flow in the circumference of a semiconductor device 1 had to be secured, and there was also a problem of receiving restrictions of a miniaturization and densification.
[0017] furthermore, the hardenability contraction resin 5 made to intervene by the mounting method which carries out potting of the hardenability contraction resin 5 to the position of the wiring substrate 3 as drawing 4 showed, and carries out the pressure welding of the semiconductor device 1 at a back process -- connection -- public funds -- there was a problem of being easy to enter the connection side of the group salient 2 and a circuit pattern 4 If a resin infiltrates into the aforementioned connection side, connection resistance will become large and the reliability of electrical installation will become low.
[0018] By the mounting method of infiltrating a resin from the side of a semiconductor device 1 among

these after carrying out the heating pressure welding of the semiconductor device 1 to the wiring substrate 3, as drawing 5 showed, it cannot be checked that the resin has fully sunk in throughout the crevice between a semiconductor device 1 and the wiring substrate 3. And in order to infiltrate a resin, you have to control the viscosity of a resin with high precision. If a resin does not fully sink into the crevice between the wiring substrates 3 of a semiconductor device 1, moisture becomes easy to infiltrate into the opening generated in the resin. If moisture infiltrates into the aforementioned opening, the reliability of a semiconductor device 1 will fall. Since the space for moreover making the nozzle 7 for sinking in approach the side of a semiconductor device 1 must be secured, other electronic parts arranged around a semiconductor device 1 will receive the restrictions on mounting.
[0019] In having been made in order that this invention might cancel such a trouble, and mounting a semiconductor device in a wiring substrate by face down, it is made not to prepare a metal salient in a semiconductor device, and while quantifying the amount of the resin by which it is placed between the mounting sections, it aims at raising the reliability of the electrical installation section.
[0020]
[Means for Solving the Problem] Subsequently, applying heat, the thermosetting resin plate manufacturing material which the conductor which has plasticity projects and by which it was prepared from front reverse side both sides between the semiconductor device and the wiring substrate is infixed, and the mounting method of the semiconductor device concerning the 1st invention is pressurized so that a semiconductor device and a wiring substrate may approach mutually, it carries out melting of the aforementioned thermosetting resin plate manufacturing material, and is stiffened further.
[0021] The mounting method of the semiconductor device concerning the 2nd invention makes the thermosetting resin plate manufacturing material which has the conductor which changed the configuration of the portion which projects from front reverse side both sides of thermosetting resin plate manufacturing material on the front reverse side intervene between a semiconductor device and a wiring substrate in the mounting method of the semiconductor device concerning the 1st invention.
[0022]
[Function] Since melting of the thermosetting resin plate manufacturing material is carried out in the state where the conductor which has plasticity deformed plastically and it was close to the semiconductor device and the wiring substrate according to the 1st invention, a resin does not infiltrate into the electrical installation section. Moreover, when a conductor deforms plastically, dispersion in the projection height is offset. Furthermore, it becomes possible to measure the amount of resins which intervenes between a semiconductor device and a wiring substrate with the size of thermosetting resin plate manufacturing material. Since melting of the thermosetting resin plate manufacturing material is moreover carried out in the state where it intervened between the semiconductor device and the wiring substrate, an opening is hard to be formed. And since thermosetting resin plate manufacturing material can be manufactured at another process with a semiconductor device, a metal salient formation process becomes unnecessary at a mounting process.
[0023] According to the 2nd invention, planar pressure in case a conductor deforms plastically comes to change on the front reverse side of thermosetting resin plate manufacturing material.
[0024]
[Example] Hereafter, drawing 1 and drawing 2 explain one example of the 1st invention in detail. Drawing 1 is a cross section for explaining the mounting method of the semiconductor device concerning the 1st invention, this drawing (a) shows the state before mounting, and this drawing (b) shows the state after mounting. Drawing 2 is the perspective diagram of thermosetting resin plate manufacturing material. About the same as that of what was explained by aforementioned drawing 4 and drawing 5 in these drawings, or an equivalent member, the same sign is attached and detailed explanation is omitted.
[0025] In drawing 1 and drawing 2 , it is the electrode terminal 12 by which 11 was formed in the semiconductor device and 12 was formed in the circuit side of this semiconductor device 11. The metal salient does not protrude on this electrode terminal 12.
[0026] 13 is a thermosetting resin board concerning this invention. This thermosetting resin board 13 is

an insulating substrate which used the epoxy resin for the base resin, and is fabricated in the physical-properties state before full individuation by the tabular, it is the part which serves as the inside from a rim, and the metal sphere 14 as a conductor is laid under the electrode terminal 12 of a semiconductor device 11, and the corresponding position. This metal sphere 14 consists of a metal (Au) excellent in deformans, for example, gold etc., and is formed in the shape of a cross-section abbreviation ellipse by making the thickness direction of the thermosetting resin board 13 into a major axis. And in this example, the longitudinal direction both ends of the metal sphere 14 are projected from front reverse side both sides of the thermosetting resin board 13.

[0027] In order to form the thermosetting resin board 13, first, thermosetting resin is formed in a tabular, and metal ****** is drilled in the electrode terminal 12 of the semiconductor device 1 in this plate, and a corresponding position, and it carries out by inserting the metal sphere 14 in the aforementioned metal ****** after that. the plate fabrication which fixed the metal sphere 14 to the predetermined position besides taking this technique -- public funds -- it is also possible to take the technique of slushing and forming thermosetting resin in type

[0028] Next, the procedure of enforcing the mounting method concerning this invention is explained. First, the thermosetting resin board 13 is made for a semiconductor device 11 to intervene between this and the wiring substrate 3 as a face down (for it to be facing down about the circuit side of a semiconductor device 1), as shown in drawing 1 (a). While making the electrode terminal 12 of a semiconductor device 11 counter the necessary circuit pattern 4 of the wiring substrate 3 and positioning both at this time, the thermosetting resin board 13 is also positioned so that the metal sphere 14 may counter with the aforementioned electrode terminal 12 or a circuit pattern 4.

[0029] And as a semiconductor device 11 and the thermosetting resin board 13 are piled up on the wiring substrate 3, the thermosetting resin board 13 is put by the semiconductor device 11 and the wiring substrate 3. While heating a semiconductor device 11 by the heating pressure-welding head 6 after an appropriate time, it is made to press to the wiring substrate 3 side, and a heating pressure welding is performed. Besides, by the heating pressure welding from the section, between the electrode terminal 12 of a semiconductor device 11, and the top lobes of the metal sphere 14, between the bottom lobe of the metal sphere 14 and the circuit patterns 4 of the wiring substrate 3 is electrically connected, when the lobe of the metal sphere 14 deforms plastically.

[0030] performing a heating pressure welding continuously -- the metal sphere 14 -- front reverse side both sides of the thermosetting resin board 13, and abbreviation -- it deforms until it becomes flat-tapped, and the electrode terminal 12 of a semiconductor device 11 is certainly connected to a circuit pattern 4 If it furthermore heats, heat will conduct from the heating pressure-welding head 6 to the thermosetting resin board 13 through a semiconductor device 11, and hardening and contraction of the thermosetting resin before full individuation will be done once through physical-properties change which changes from a rubbery state to a hyperviscous liquid and a hypoviscosity liquid.

[0031] While controlling the deformation state of the metal sphere 14 by controlling the height of the heating pressure-welding head 6 from the upper part of a semiconductor device 11 at this time, the resin streak in the time of the liquefaction state of the thermosetting resin board 13 is controlled.

[0032] As mentioned above, after melting of the thermosetting resin board 13 is carried out, as shown in drawing 1 (b), by hardening and contracting, a semiconductor device 11 will be mounted on the wiring substrate 3.

[0033] Therefore, since melting of the thermosetting resin board 13 is carried out in the state where the metal sphere 14 which consists of a conductor which has plasticity deformed plastically, and it was close to the electrode terminal 12 of a semiconductor device 11, and the circuit pattern 4 of the wiring substrate 3, a resin does not infiltrate into the electrical installation section. For this reason, it can prevent certainly connection resistance becoming large by permeation of a resin, and the reliability of electrical installation can be raised.

[0034] Moreover, this dispersion comes to be offset by the aforementioned plastic deformation, though the configuration of the metal sphere 14 is irregular and dispersion is in projection height from the front rear face of the thermosetting resin board 13, since the metal sphere 14 deforms plastically and an

electrode terminal 12 is electrically connected to a circuit pattern 4.
[0035] Furthermore, since it becomes possible to measure the amount of resins which intervenes between a semiconductor device 11 and the wiring substrate 3 with the size of the thermosetting resin board 13, it is easy to set this amount of resins constant, and it can prevent the amount of resins becoming inadequate certainly. Since melting of the thermosetting resin board 13 is moreover carried out in the state where it intervened between the semiconductor device 11 and the wiring substrate 3, an opening is hard to be formed into a resin.
[0036] For this reason, moisture stops being able to permeate easily and the reliability in the damp-proof viewpoint of a semiconductor device 11 can be raised. Since quantification of a resin can be attained, it becomes unnecessary in addition, to be able to press down the resin which flows into the circumference of a semiconductor device 11 few as much as possible, and to provide an excessive space for the circumference of a semiconductor device 11. That is, it becomes possible to make other electronic parts arranged around a semiconductor device 11 approach a semiconductor device 11 compared with the former, high density assembly is possible and a miniaturization can be attained. Moreover, since it is not necessary to secure the arrangement space of the nozzle for sinking in compared with the case where the technique of pouring in a resin from the method of outside by the nozzle for sinking in between a semiconductor device 11 and the wiring substrate 3 is taken, other electronic parts arranged around a semiconductor device 11 do not receive the restrictions on mounting.
[0037] And since the thermosetting resin board 13 can be manufactured at another process in a semiconductor device 11, a metal salient formation process becomes unnecessary at a mounting process. For this reason, the lead time which manufacture takes compared with the case where it mounts in a semiconductor device by forming a metal salient can be shortened.
[0038] Next, drawing 3 explains the mounting method of the semiconductor device concerning the 2nd invention in detail. Drawing 3 is the cross section of the thermosetting resin board used in enforcing the mounting method of the semiconductor device concerning the 2nd invention. About the same as that of what was explained by aforementioned drawing 1 and drawing 2 in this drawing, or an equivalent member, the same sign is attached and detailed explanation is omitted.
[0039] It is the piece of a metal which is shown with a sign 21 in drawing 3 , and this piece 21 of a metal is equally constituted, except that the configuration differs from the metal sphere explained in the aforementioned example. The configurations of the portion which is formed cylindrically and projects from front reverse side both sides of the thermosetting resin board 13 where the piece 21 of a metal penetrates the thermosetting resin board 13 differ on the front reverse side.
[0040] Namely, as for the portion which projects from the thermosetting resin board 13 in the piece 21 of a metal, the cross section is formed in the shape of an abbreviation stairway. If it explains in full detail, the portion which projects from the thermosetting resin board 13 in the piece 21 of a metal to the bottom in drawing 3 is formed so that the width of face of a cross section may become large to the portion which projects to the bottom, and the superficies of the upper-limit section incline so that it may become narrow gradually as it goes upwards. In addition, the upper-limit side is formed evenly.
[0041] On the other hand, the portion which projects from the thermosetting resin board 13 in the piece 21 of a metal to the bottom in drawing 3 is formed so that cross-section width of face may become narrow with a level difference as it goes below. The soffit side is formed evenly.
[0042] Thus, the thermosetting resin board 13 equipped with the formed piece 21 of a metal is infixed between a semiconductor device 11 and the wiring substrate 3, as shown in aforementioned drawing 1 , and it is used like the aforementioned example. When this thermosetting resin board 13 is compressed by the semiconductor device 11 and the wiring substrate 3, the planar pressure when deforming plastically by the difference in a plane-of-composition product comes to differ by the top lobe and bottom lobe of the piece 21 of a metal. That is, since it becomes possible to control the pressure of the electrical installation section according to the difference of the mechanical strength of a semiconductor device 11 and the wiring substrate 3, the difference of the stress resulting from the mechanical on-the-strength difference of the material silicon which constitutes a semiconductor device 11, and the ceramic and glass epoxy which constitute the wiring substrate 3 is cancelable.

[0043] In addition, although the length of the lobe of the piece 21 of a metal sphere 14 metallurgy group was considered as abbreviation regularity in each example mentioned above, in consideration of the parallelism of a semiconductor device 11 and the wiring substrate 3, and flatness, the length of a lobe is also changeable. By doing in this way, connection between the electrode terminal 12 of a semiconductor device 11 and the circuit pattern 4 of the wiring substrate 3 can much more be ensured.
[0044]
[Effect of the Invention] The mounting method of the semiconductor device which starts the 1st invention as explained above The thermosetting resin plate manufacturing material which the conductor which has plasticity projects and by which it was prepared from front reverse side both sides between the semiconductor device and the wiring substrate is infixed. subsequently In order to pressurize so that a semiconductor device and a wiring substrate may approach mutually, to carry out melting of the aforementioned thermosetting resin plate manufacturing material and to make it harden further, applying heat, Since melting of the thermosetting resin plate manufacturing material is carried out in the state where the conductor which has plasticity deformed plastically and it was close to the semiconductor device and the wiring substrate, it can prevent a resin infiltrating into the electrical installation section certainly. Moreover, when a conductor deforms plastically, dispersion in the protrusion height comes to be offset. For this reason, connection with the stable high reliability is attained.
[0045] Furthermore, since it becomes possible to measure the amount of resins which intervenes between a semiconductor device and a wiring substrate with the size of thermosetting resin plate manufacturing material, moreover, since melting of the thermosetting resin plate manufacturing material is carried out in the state where it intervened between the semiconductor device and the wiring substrate, an opening is hard to be able to set the amount of resins constant easily, and to be formed. For this reason, it can prevent originating in moisture etc. permeating and reliability falling.
[0046] Since quantification of the resin between a semiconductor device and a wiring substrate can be attained and it can stop few that a resin flows into the circumference of a semiconductor device as much as possible further again, the restrictions to the part arrangement around a semiconductor device decrease, it is possible in high density assembly, and a miniaturization can be attained. Since it is not necessary to secure the arrangement space of the nozzle for sinking in compared with the case where the technique of pouring in a resin from the method of outside by the nozzle for sinking in between a semiconductor device and a wiring substrate is moreover taken, other electronic parts arranged around a semiconductor device do not receive the restrictions on mounting.
[0047] In addition, with a semiconductor device, since thermosetting resin plate manufacturing material can be manufactured at another process, a metal salient formation process becomes unnecessary at a mounting process, and it can aim at lead time shortening of manufacture.
[0048] In the mounting method of the semiconductor device concerning the 1st invention, the mounting method of the semiconductor device concerning the 2nd invention comes to change planar pressure in case a conductor deforms plastically on the front reverse side of thermosetting resin plate manufacturing material in order to make the thermosetting resin plate manufacturing material which has the conductor which changed the configuration of the portion which projects from front reverse side both sides of thermosetting resin plate manufacturing material on the front reverse side intervene between a semiconductor device and a wiring substrate.
[0049] for this reason, the difference of the mechanical strength of a semiconductor device and a wiring substrate -- responding -- a conductor -- it becomes possible to control the pressure of a connection

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[Translation done.]

* NOTICES *

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] In the mounting method of the semiconductor device performed by making resin material intervene among both in connecting a semiconductor device to a wiring substrate by face down The thermosetting resin plate manufacturing material which the conductor which has plasticity projects and by which it was laid underground from front reverse side both sides between the semiconductor device and the wiring substrate is infixed. subsequently The mounting method of the semiconductor device characterized by pressurizing applying heat so that a semiconductor device and a wiring substrate may approach mutually, carrying out melting of the aforementioned thermosetting resin plate manufacturing material, and making it harden further.
[Claim 2] The mounting method of the semiconductor device characterized by making the thermosetting resin plate manufacturing material which has the conductor which changed the configuration of the portion which projects from front reverse side both sides of thermosetting resin plate manufacturing material on the front reverse side in the mounting method of a semiconductor device according to claim 1 intervene between a semiconductor device and a wiring substrate.

[Translation done.]